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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

U.S. Serial No.: 10/709,065
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Applicant: Norek, Richard S.
Title: FORMING GAS TURBINE TRANSITION DUCT BODIES
WITHOUT LONGITUDINAL WELDS
Atty. Docket No.: NOR.US.6
Art Unit: 3726
Examiner: Jimenez, Marc Quemuel

Commissioner for Patents
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DECLARATION OF RICHARD S. NOREK
37 CFR § 1.132

I, Richard S. Norek, the applicant in the above-referenced application, hereby declare the following:

1. I have an MSME from Rensselaer Polytechnic Institute. I have a broad engineering experience; 6 yrs in academia, 12.5 years in industry, 18 years in consulting for a large gas turbine user, and 7 years as independent consultant and inventor. My industrial experience has been mainly in the field of gas turbines, specifically hot gas path components made of superalloys. My fields of expertise include stress analysis, creep, fracture mechanics, vibrations, rotor dynamics, hot corrosion and overall material behavior and life extension. During 18 years employment in Aramco and Saudi Aramco (largest oil producing company in the world) I served for 13 years as No.1 turbine expert in the company ultimately responsible for the overall performance of a diversified gas turbine fleet of 214 units, refurbishment of hot gas path components in 20 repair facilities worldwide, and personally responsible for the quality of replacement parts, new and refurbished, in the company stock.

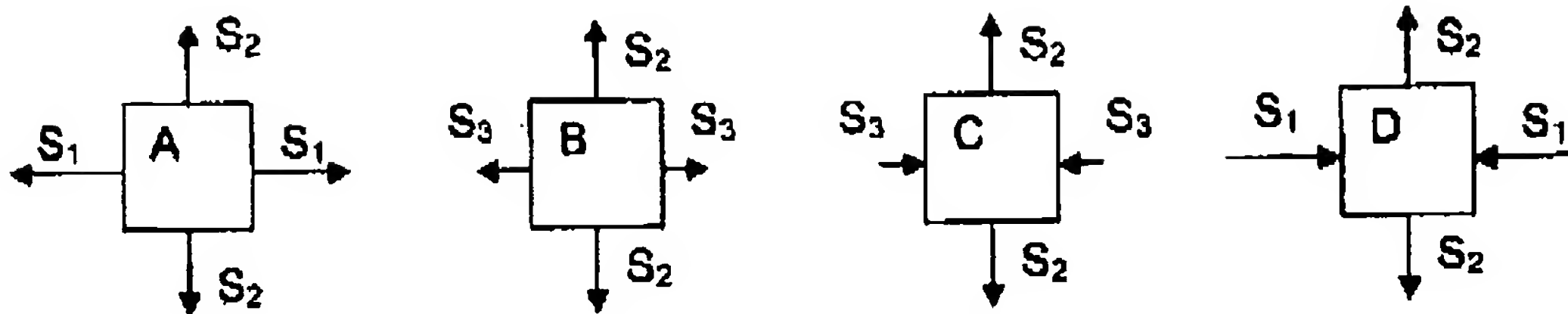
I have 12.5 years of experience with General Electric as a design/development engineer of 14 turbine models, including stationary and rotating mechanical

components. My responsibility included a development of the 2-nd stage nozzle for a 200 MW gas turbine, which was considered the most complicated nozzle in the GE product line at the time. As a design technology unit member, I was responsible for bringing advanced engineering tools to the company design engineering practice. As an independent consultant/inventor, I published/presented two papers and was awarded four US patents. My curriculum vitae is attached (Exhibit A).

2. That one of the differences between my invention and the prior art is the use of bellows. The term bellows is adopted from the expansion bellows installed commonly at the ends of pressurized pipes to allow for sizeable thermal expansion of the pipe ends without producing excessive axial load in the pipes. These bellows are made out of a very high strength sheet metal and appear from the outside like an accordion.

3. That the pipe endings in the present patent application are called "thrust bellows" because, in addition to folds, they are designed to exert a substantial compressive axial force (thrust). The thrust is generated as the folds are straightened under high internal pressure in the pipe, resulting in a sizeable displacement of the pipe ends towards the pipe's center. The thrust produces compressive stresses in the pipe (work piece item 50) over the entire length of the pipe, and the thrust varies circumferentially. The thrust is designed to compress the most those longitudinal fibers of the work piece 50 that experience the most bending in the hydroforming process. The local compressive stresses (axial) in the work piece material in the presence of local tension stresses (tangential) cause both a local yield and a flow of the material that reduce wall thinning.

4. That those skilled in the art know that the local yield in the material depends on the local (specific) energy of shear deformation. Asymmetric stresses in two dimensional stress fields of the work piece wall, where the one dimension is axial and the second is tangential, produce more shear energy (easier yield) than a symmetric stress field. The sketches that follow illustrate the point.



S_1, S_3 – axial stress
 S_2 – tangential stress
 $|S_3| < |S_1|$

5. That the stress field A is symmetric, in that $|S_1| = |S_2|$. The fields B through D are asymmetric. The stress field D will produce yield at the lowest stress level among A, B, C, and D; that means at the lowest inner pressure in the workpiece. To be more precise, the equivalent, von Mises stress will be the highest for the stress field A and the lowest for the stress field D (von Mises hypothesis is known also as Huber/Mises/Hencky hypothesis based on the names of its authors. Ref. 1).

6. That the bellows thrusters of the present invention actually exert an axial thrust on the ends of the work piece 50 and move them inward, thus do significant supporting work in the forging process.

7. That the thrusters in the present application serial number 10/709,065 (the '065 application) are very distinguishable from the prior art. A short examination of comparisons with the end discs of Schulz and the end caps of Komiya confirms this:

	'065 Application	Schulz	Komiya
1. Name	"bellows thruster"	"end disc"	"bottom member"
2. Form	conventional seal weld of workpiece	conventional seal weld of workpiece	conventional seal weld of workpiece
2a	hemi-spherical (or parabolic) outside envelope of bellows (ridges)	round, flat disc	shallow dish, or hemi-spherical
2b	non-ax symmetric	ax symmetric	ax symmetric

2c	uniform or non-uniform	uniform	uniform
2d	novel pressure vessel (tension tangential stresses; compressive axial stresses varying circumferentially)	conventional pressure vessel	conventional pressure vessel
2e	conventional access to the vessel (valved)	conventional access to the vessel (valved)	conventional access to the vessel (valved)
3. Function	active: bellows thrusters provide variable axial thrust along pipe perimeter	passive	passive
3a	variable axial thrust provided by internal pressure in the workpiece	small axial tension provided by internal pressure (no thrust)	axial thrust provided by the dies
3b	variable yield, tailored to local bending rate	conventional yield	yield less than conventional but not variable.
3c	a degree of wall thinning control, thinning less than conventional	no wall thinning control, thinning conventional	no wall thinning control, constant thinning less than conventional

8. That bellows thrusters provide significant improvements to the state of the art. Neither Schulz nor Komiya use the term "bellows." My use of "bellows" is intentional and is one of the technical differences between my invention and the prior art.

Declarant further states that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false

statements may jeopardize the validity of the application or any patent issued thereon.

Reference 1: *Strength of Materials*, (In Polish), p 205, Jakubowicz, A., Orlos, Z., WNT, Warsaw, 1966.

Date: 11/23/05 Name: Richard S. Norek
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